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ASSESSMENT OF EGYPT'S RICE POLICY AND STRATEGIES FOR WATER MANAGEMENT

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The Rice Working Group, composed of members from the MPWWR, the MALR, and APRP was formed to review policy problems associated with water scarcity and the cultivation of rice in Egypt. The Group used the Participatory Rapid Appraisal method for this activity. It examined previous studies, reports, and data, and invited presentations from or interviewed other experts in the various fields of agronomy, water resources and the physical system, and economics. The Group received information on the available water supply, the water use by rice and other crops, both individually and in rotation, and the economic incentives and disincentives to rice cultivation. From these data, possible short and long term policies were identified which could lead to the optimal use of water in rice cultivation. The group examined existing policy alternatives, with a special emphasis on those which already have a basis in Egypt's legal system, to determine what policies would be most effective in the short and long run. Several short term recommendations were made. Long term recommendations for water allocation and distribution were made regarding potential policies once the implementation of full water control in the Nile system is achieved.

In addition, the Working Group was instrumental in the development of a policy test area in the Kafr El-Shiekh Governorate on the Sidi Gammea Canal to examine the measurable water savings from the introduction of new short-season varieties of rice. The results of that test will be available in November, 1998.

The Working Group developed five recommended policy options. The following are brief descriptions of each policy option. Each is targeted at decreasing water demand by reducing either consumptive use by or area in rice cultivation.

<u>Policy Option 1: Land Limitation on Illegal Rice Production.</u> In 1997, about 23,000 feddan of rice were grown outside of the official permitted rice growing areas. If this illegal cultivation could be prevented, expected water savings could be as much as 0.047 bcm of consumptive use, or 0.09 bcm in diversions. Both the MPWWR and the MALR should apply appropriate policy measures including destruction of nurseries and/or permanent fields.

<u>Policy Option 2: Prevent Illegal Cultivation in Official Rice Growing Areas</u> In 1997, about 434,600 feddan in the Delta and 21,800 feddan in Fayoum

were illegally planted to rice in the official (permitted) rice growing areas. If this illegal cultivation could be prevented, expected water savings could be as much as 0.88 bcm of consumptive use, or 1.66 bcm in diversions, in the Delta; and 0.057 bcm of consumptive use, or 0.09 bcm in diversions in Fayoum. Policy measures for controlling this illegal cultivation include effective water fines and additional land and/or crop taxes.

Policy Option 3:Introduce Short-Duration Varieties and Modern Farming Techniques Substitution of short duration varieties (~120 days) for longer season varieties (~160 days) could reduce water diversions by 25%. The expected water savings on 1 million feddans could be as much as about 1.26 bcm of consumptive use or 2.0 bcm in diversions. Policy measures needed for this option include a ministerial decree and a national extension campaign to provide education and information to rice growers concerning the short duration varieties.

The total expected water savings from the first three policy options could amount to about 2.42 bcm of consumptive use or about 4.17 bcm in diversions (on 1 million feddans).

Policy Option 4: Better Water Control in Permitted Rice Growing Areas Better water management and control of water in permitted rice growing areas can be accomplished through 1) establishment of Water User Associations, 2) introduction of modified drainage systems, and 3) removal of physical bottlenecks in the irrigation delivery system, where required, to improve water distribution.

Policy Option 5:Elimination of the Rice Import Duty. The intended impact of the removal of the rice import duty is to decrease the rice farm-gate price, and hence the desirability of rice as crop choice. There is little hard empirical evidence relative to the effect.

Major recommendations include:

1. Conduct a national campaign to introduce short duration rice varieties throughout all official rice growing areas.

2. Implement a program to eliminate the import tariff on white and baladi rice and conduct a comprehensive study on the effect of eliminating the rice import tariff on rice area and production.

3. Conduct a public awareness campaign on water scarcity targeted to farmers in official rice growing areas.

4. Reconsider how much rice should be legally grown in Egypt taking into consideration future needs and constraints.

5. Plan and implement effective programs for effective control of illegal rice production.

6. The physical and economic impacts of introducing short duration varieties in a policy testing area, as well as the existing physical and economic measures, should be evaluated and monitored as part of Tranche III.

1. INTRODUCTION

1.1 Overview

Egypt's Nile River water resource is under increasing stress due to increasing competition for available water. Irrigation needs are expanding, as are domestic and industrial water needs due to population and industrial growth. An increasing load of pollutants is threatening Egypt's water quality, environment and the health of its citizens. The Ministry of Public Works and Water Resources (MPWWR) is the primary Egyptian governmental agency charged with the management of water resources. Keenly aware of the need to improve the utilization efficiency, productivity, and protection of water resources in Egypt, the MPWWR and the US Agency for International Development (USAID) in 1996-97 developed a "water resources results package" based upon years of earlier joint experience in water resources management projects.

The package had four major results: 1) improved irrigation policy assessment and planning process, 2) improved irrigation system management, 3) improved private sector participation in policy change, and 4) improved capacity to manage the policy process. The MPWWR and USAID designed the water resources results package aimed at policy analyses and adjustments leading to improved water use efficiency and productivity. Specific objectives are:

1) To increase MPWWR knowledge and capabilities to analyze and formulate strategies, policies and plans related to integrated water supply augmentation, conservation and utilization, and to the protection of the Nile water quality.
2) To improve water allocation and distribution management policies for conservation of water while maintaining farm income.
3) To recover the capital cost of mesqa improvement, and to establish a policy for the recovery of operation and maintenance costs of the main system.
4) To increase users' involvement in system operation and management.
5) To introduce a decentralized planning and decision making process at the irrigation district level.

In early 1997, the water resources results package was folded into the USAID Mission's Agricultural Policy Reform Program (APRP). APRP is a broad-based policy reform program involving five Egyptian Ministries (Ministry of Agriculture and Land Reclamation (MALR), MPWWR, Ministry of Trade and Supply (MOTS), Ministry of Public Enterprise (MPE) and Ministry of International Cooperation). APRP has the goal of developing and implementing policy reform recommendations in support of private enterprise in agriculture and agribusiness.

USAID supports the MPWWR in five program activities under APRP. These five activities are: 1) water policy analyses, 2) water policy advisory unit, 3) water education and communication, 4) main systems management, and 5) Nile River monitoring, forecasting and simulation. USAID supports the Ministry's efforts through cash transfers (tranches) based on performance in achieving identified and agreed upon policy reform benchmarks and technical assistance.

Technical assistance for the water policy analysis activity is provided through a task order (Contract PCE-I-00-96-00002-00, Task Order 807) under the umbrella of the Environmental Policy and Institutional Strengthening Indefinite Quantity Contract (EPIQ) between USAID and a consortium headed by the International Resources Group (IRG) and Winrock International. Local technical assistance and administrative support is provided through a subcontract with Nile Consultants.

Egypt is almost entirely dependent upon a fixed supply of water from the High Aswan Dam (HAD) of 55.5 billion cubic meters (bcm) by international agreement. Over the past two decades, improved water control in the Nile Basin has permitted the Government of Egypt (GOE) to invest in "new" lands. As a result, the number of irrigated feddans has risen from 6.6 million in 1974 to 7.97 million in 1997. In the past two years, the GOE has announced a commitment to the further expansion of irrigated agriculture into currently un-farmed lands in the

Toshka and Sinai regions of the nation, as well as smaller projects in areas parallel to the Nile. These expansions are expected to achieve several objectives, including economic growth, the easing of urban population pressures, the reduction of unemployment, particularly in Upper Egypt, and national security in general.

Because of increasing population of Egypt, horizontal expansion plans, and targeted economic development, it is clear that improved management of the currently available water resources is urgently needed. More attention should be oriented toward increasing water productivity to cope with the new and increasing water demand, i.e., Egypt needs to produce more with less water.

1.2 Purpose of the Report

One of the agreed upon benchmark activities for Tranche II of the Agricultural Policy Reform Project (APRP) was to develop a national strategy for the optimal use of water in rice production. This is a joint benchmark between the Ministry of Agriculture and Land Reclamation (MALR) and the MPWWR. This report provides a part of the analytical bases for the development of the strategy for optimal use of water in rice production.

1.3. Methodology and Approach

The Participatory Rapid Appraisal (PRA) method was used in the policy analysis. This method requires an interdisciplinary team which collects secondary data, studies, and reports and conducts interviews in order to gain knowledge about a topic. The Rice Working Group was formed by the APRP in conjunction with the MARL and MPWWR, and consisted of members from the MALR (agronomists), the MPWWR (water engineers), and economists from APRP (EPIQ and RDI). This Working Group met to discuss data and policy alternatives, to receive presentations from other experts from the MALR, MPWWR, and APRP, to review reports and studies, to make field trips, and to interview stakeholders in the policy formation. Several meetings were held in Cairo and a field trip was taken to the Kafr El-Sheikh Governorate to observe water distribution, rice production practices, and problems in the area. Individual members of the Working Group also collected reports, reviewed studies, and interviewed various experts in rice production and water resources.

1.4 Organization of the Report

This report is organized in four main chapters (Chapters 2-5). Chapter two gives a review of the background of the problem. Chapter 3 considers possible augmentation of the water supply in the Nile System. Chapter 4 provides as comprehensive a review of possible policy alternatives to meet water scarcity as possible given time constraints, and an assessment of the strengths and weakness of each. Chapter 5 summarizes the findings and presents policy recommendations.

2. BACKGROUND

The following sections discuss the problem of water scarcity in more detail, and the problem which expanding rice production poses in particular.

2.1 Water Availability and Use

The first step in the analysis is to examine the current water uses to identify both the problems of and potential solutions to water scarcity. The current consumption of water is presented in Table 2.1. The differences between the two sources for the consumptive use data are most likely due to definitions of evapotranspiration and evaporation losses, and in points of measurement. Rapid population growth continues to lead to increasing demands for municipal and industrial (M&I) water, as well as reducing the available clean water as pollution from M&I wastewater increases. Thus, the water resources of Egypt are increasingly being put "under pressure," and water scarcity, previously not a significant problem in normal years, has become an important issue.

It should be noted that water scarcity arises, in part, from the GOE's own policies with regard to water and agriculture. For example, import protection has been given to crops which consumptively use relatively large amounts of water (rice and sugar cane). Moreover,

water has been provided by the GOE as a "free" input to farmers. The result is that farmers have no incentive to conserve water as well as strong market incentives to grow these crops.

As a consequence of the scarcity, the GOE, and particularly the MPWWR and the MALR has turned its attention to both additional water supplies and to water saving alternatives, with the objective of meeting the "new" demands without serious detriment to existing water users. A wide variety of water-saving alternatives are being considered, including increasing the overall efficiency of water use through improved irrigation (the Irrigation Improvement Program, or IIP),

Table 2.1. Water Availability and Uses.

Water Source/Use	Available water (Bcm)	Consumptive use (bcm) 1995/96[a]	Consumptive use (bcm) 1996/97[b]
High Aswan Dam	+ 55.5	--	--
ET of crops		40.8	36.5
M&I consumption		1.4	3.0
Evaporation from system		3.0	2.4
Evaporation from weeds	.	--	0.7
Outflows to Fayoum Depressn		0.7	0.5

Fresh water outflows to sea		0.26	0.1
Drainage outflows to lakes & sea		12.4	12.4

[a]Attia, et al., 1997; note that these data include rainfall (1.0 bcm), salt water intrusion
(2.0 bcm), and weed evapotranspiration as a part of the estimated crop consumptive use.
[b]Elwan, personal communications to the Rice Working Group, 1998, citing Zhu and Yakoub, 1995)

reusing drainage water from agriculture and treated M&I wastewater, and reducing the consumptive use of current cropping patterns. Rice and sugar cane, as the highest water-consuming crops, have come under scrutiny as potential sources of water savings.

2.2 Rice Production and Water Use

Since liberalization of farmer choice of cropping patterns, the number of feddans on which rice is grown has almost doubled, from about 800,000 feddan in 1988 to 1.56 million feddan in 1997 (Table A.1), replacing cotton and maize in the summer season. Early indications suggest even greater rice production is planned by farmers in 1998 (Elwan, personal communication to the Rice Working Group, 1998). This rapid increase in rice cultivation has resulted from increasing profitability relative to other crops and rotations, as well as other factors (See Tables 2.2 and 2.3).

While an extended treatment of farmer decision-making is beyond the scope of this document, a brief review will establish a base from which policy recommendations may be made. Economic models generally focus on profit and/or utility maximizing behavior to explain choices which are made. In the case of crop selection, the profitability of rice relative to other crops would be considered as crucial. However, other aspects of this choice are apparent in Table 2.3. Cotton, the next-most-profitable crop, has characteristics which make it less attractive to farmers. It is difficult to grow, and sensitive to climatic fluctuations and diseases. Further, world prices of cotton have fallen relative to those of rice over the past decade, particularly at the farm gate. In part, import tariffs on rice imposed by the GOE have generated higher and more stable rice prices. Thus, the risk associated with cotton is likely perceived as much higher and the expected value much lower than the average deterministic calculations found in Table 2.2. In addition, the increased availability of local village rice milling capacity has made the crop more attractive to farmers, from both profitability and home consumption considerations. These factors, coupled with the fact that water is provided free of charge to farmers (with the possible exception of local pumping and operation charges at the mesqa level), provide incentives for farmers to switch to rice cultivation[1] (Table A.1).

The drastic increase in water use in rice cultivation is putting added pressure

[1]Sugar cane has also increased slightly, by about 50,000 feddan

on water supplies, and threatens to undermine the availability of water for the "new lands."

Table 2.2. Financial[a] returns (profitability) of various crop rotations (LE/fed)

Rotation/Year	1992[b]	1992[c]	1995[c]	1996[c]
Rice + L. Berseem	1,508	1,707	2,344	2,831
Rice + Wheat	1,573	1,438	1,746	2,150
Rice + Broadbean	1,168[d]	918	1,544	1,809
Rice + Sugar Beet	1.179[d]	750	1,588	1,620
Cotton + S. Berseem	2,519	2,271	2,281	2,500
Cotton + Sugar Beet	2,574[d]	1,850	2,253	2,181
Cotton + Broadbean	2,521[d]	2,019	2,209	2.371
Maize + Wheat	1,272	1,319	1,036	1,467
Maize + L. Berseem	1,277	1,559	1,636	2,148

[a]Financial returns are defined as the difference between farm revenues (using farm gate prices) and the on-farm costs of production
[b]Taken from Hussain, Young and El-Kady, 1995 and Hussain, et. al, March, 1995; this study treated farm family opportunity cost of time as an on-farm cost of production, but excluded land rent.
[c]Taken from MALR Economic Affairs Sector, Bulletin of Agri-Economics, 1995 and from unpublished data for the same publication for 1996; excluding farm

family opportunity cost of time but including land rent as on-farm production costs.
[d]Computed from separate crop profitabilities from Hussain, Young and El-Kady, 1995.

Table 2.3. Reasons given by producers for growing rice, percent by farm size[a]

Reason given/Farm size (feddan)	<1	1-5	>5	Total
Home consumption	88.5	89.4	57.1	88.0
Comply with rotations	61.5	56.7	71.4	58.5
Elimination of Compulsory Procurement	30.8	47.5	71.4	44.0
Rice more profitable/increase in price	38.4	44.7	42.9	24.0
Other (salinity, habit, seed availability, etc.)	0.0	2.1	14.3	3.5
Percent of sample rice area	8.8	71.3	19.9	100.0

[a]Wailes, et al., 1995

Further, the capacity constraints on certain canals in the system coupled with expanding rice cultivation prevent sufficient water from being delivered to newly reclaimed land at the "tails" of the canals. On the other hand, Egyptian farmers are among the leaders of the world in productivity per unit of land for both rice and sugar cane. Reducing rice cultivation will result in significant losses to farmers and, perhaps, to the Egyptian economy as a whole. Clearly, identification of potential policy reforms and analyses of the relative costs and benefits of those reforms are required in order to assure both an effective policy and the maintenance of the stability and economic security of Egyptian farmers.

One caveat is extremely important to this issue. As the GOE reallocates water to "new lands" in Toshka, the Sinai, or elsewhere, the availability of water to old lands must be diminished unless losses from the Nile System (in the form of evaporation, evapotranspiration, leakage to unavailable groundwater, and outflows) can be reduced. The simple water balance for the Nile System (found in Table 2.1) with its fixed supply indicates that any increased consumptive use in the system must be balanced by an offsetting decrease in consumptive use elsewhere in the system. There is a clear difference between reducing diversions and reducing consumptive use. It is the latter which is at issue here.

2.3 Objectives of the Analysis

The remainder of this document includes the following: First, as exhaustive a list of potential solutions to water scarcity as possible will be discussed, followed by the identification of constraints and limitations which may affect the effectiveness of each of those solutions. While some general solutions will be discussed, the principle focus will be on rice production. A summary of the potential of these solutions will then be presented, followed by a set of short- and long-term policy recommendations.

3. POTENTIAL STRATEGIES FOR WATER AUGMENTATION

The GOE has a wide range of possible policy strategies to meet its increasing demands for water to consider, including both augmentation of effective supplies and limitations on water consumption. Within each of these two broad types of policies are several options. Each is discussed briefly below, along with its constraints. However, it should be made clear that only consumptive use reductions will actually "free" water for use elsewhere. There are two general opportunities for augmenting effective supply to agriculture in Egypt. The first is through developing other sources of water and the second is to reduce outflows from the system.

3.1. Upper Nile Project and Deep Groundwater

Water developments have been proposed for the Upper Nile Basin, including the reduction of phreatophytic losses to wetlands in Sudan, and the construction of the Jonglei Canal to deliver water to the Nile system. Deep groundwater development and transport has also been suggested in the past as a possible source from which to add to the flow of the Nile.

3.1.1 Constraints and Limitations The Jonglei Canal has had a relatively long history in Egyptian planning. However, construction was halted due primarily to political unrest. It does not appear that this alternative can be completed within the time frame necessary to provide water for the "new" lands (Elwan, personal communications to the Rice Working Group, 1998). The latter alternative, although physically feasible, appears to be economically unjustified. The lifting and transport of deep groundwater to the Nile are very costly. Moreover, those groundwater resources can be applied at the source to irrigate “new” lands (Keller and El-Kady, 1995). Thus, adding to the flow of the Nile appears to be a possibility only in the distant future, and will likely not affect the water scarcity which faces Egypt in the short or medium terms.

3.2. Reduction of Outflows and Increasing Use of Return Flows

The second source of augmentation is to reduce the outflow of water from the Nile to the Northern lakes and the Mediterranean Sea, and to the Fayoum Depression, by increasing reuse of return flows throughout the Nile Basin. In particular, “capturing” drain water and ground water recharge at the end of the system (North Delta) is crucial.

3.2.1 Constraints and Limitations While this approach has been recognized as a significant source of “saved” water, the current outflow to the Northern Lakes and the Mediterranean Sea of 12.5 bcm can only be reduced to about 8.4 bcm and still maintain the integrity of fisheries in the Northern lakes and the environmental quality of the Mediterranean along the coast (Imam and Ibrahim, 1996). The 0.5 bcm flow to the Fayoum Depression is the minimum necessary to provide for maintenance of the lake ecosystem and tourism in the region. No water savings can be made from this source without severe economic repercussions. Given the augmentation of effective supply by 4 bcm through increasing reuse of water, there would still be a shortfall of at least 5 bcm of water for the "new" lands at full development. Thus, changing the consumptive use by crops appears to be necessary in order to meet the added demands of the "new lands." It should also be noted that, as fresh water becomes less available and reuse increases, the quality of water available for reuse will decline, leaching fractions will increase, and productivity will decline as well.

4. POTENTIAL STRATEGIES FOR WATER SAVINGS IN RICE CULTIVATION

Since rice is the focus of this paper, only limitations on water consumption by rice will be considered below. This reduction in rice consumption of water encompasses physical constraints on production or supply, combinations of physical and economic constraints, and purely economic constraints

4.1 Physical Approaches to Reducing Rice Water Consumption.

Possible physical approaches include limiting the land which can be used in cultivation of rice, limiting the water available for cultivation of rice, finding rice varieties which will reduce consumptive water use, and increasing on-farm water use efficiencies.

4.1.1 Land Limitations on Illegal Production Historically, the GOE has designated some lands as "legal" or "rice growing" areas. These lands are generally found in the delta regions. Governorates in which rice cultivation is "illegal" are the Qalyoubya and Menofya Governorates . These lands have seen a substantial increase in rice cultivation since 1988 (see Table A.1). Outside the "legal" boundary, that is, in those two governorates, the prohibition on rice has been and could be readily rationalized in the sense that the policy is already in place and that no farmer "legally" has the option to grow rice. In 1997, there were about 23,000 feddan of rice being grown "illegally" in these areas (see table A.1).

Water savings from converting “illegal” rice cultivation to other crops, in terms of diversion requirements at the field level and of consumptive use are found in Table 4.1. Switching from rice rotation to cotton rotations with various winter season crops will generally provide a reduced field (diversion) requirement of from about 2,200 to about 3,800 m^3/feddan in the Delta, and 2,500 to 4,200 m^3/fed in Middle Egypt, with a corresponding reduction in consumptive use from 1,000 to 2,000 and 1,500 to 2,600 m^3/feddan. The rotational shift from rice/long berseem to the next most profitable rotation, cotton/short berseem, would reduce field requirements by 3,800 m^3/feddan in the Delta and 4,200 m^3/feddan in Fayoum, with a corresponding reduction in consumptive use of 2,000 and 2,600 m^3/feddan, respectively. The maximum possible gain in water savings would result from a shift from a rice/sugar beet rotation to a cotton/short berseem rotation (4,400 m^3 per feddan of diversion requirement and 2,700 m^3 per feddan of consumptive use). Shifting from a rice/sugar beet rotation to a cotton/sugar beet rotation would reduce diversion and consumptive use by about 2,000 m^3 and 1,000 m^3, respectively. A switch from other rice rotations to a cotton/sugar beet rotation would decrease water diversion and consumptive use requirements only slightly, or, in some cases, actually increase use. Table 4.2 presents the associated changes in profitability (net farm income) from these rotational changes. Note that some rotation changes from rice to cotton would yield increases in net farm income, as calculated from individual crop budgets since cotton as an individual crop has a profit advantage over rice in that comparison (1,788.7 compared to 1,226.9 LE/fed at 1996 farm gate prices).

Farmer preference for rice in the face of these profitability calculations can be explained by several factors. First, as indicated in Table 2.3, home consumption is a very important aspect of rice production. Next, cotton production involves a relatively risky market in which world prices have declined for the past few years. Finally, the values calculated depend to some extent on the assumptions made about costs and may not reflect the farmer's decision-making criteria. For example, land rent may not be explicitly considered by land owners in decisions about cropping patterns. These data, and the supply response by farmers, are not known at present, and should be analyzed fully.

Table 4.1. Diversion at the field level and consumptive use requirements for alternative crop rotations in the Delta (D) and in Fayoum (F).

Crop Rotation (Summer/Winter)	Field requirements (cum per feddan)[a]	Consumptive Use (cum per feddan)[b]
Rice + L. Berseem	8,000[c] + 2,940 = 10,940 (D) 8,662[c] + 3,511 = 12,171 (F)	4,691[c] + 1,850 = 6,541 (D) 5,457[c] + 2,212 = 7,669 (F)

Rice + Wheat	8,000[c] + 1,995 = 9,995 (D) 8,662[c] + 2,860 = 11,522(F)	4,691[c] + 1,256 = 5,947 (D) 5,457[c] + 1,801 = 7,258 (F)
Rice + Broad bean	8,000[c] + 2,810 = 10,810 (D) 8,662[c] + 2,880 = 11,542 (F)	4,691[c] + 1,770 = 6,461 (D) 5,457[c] + 1,815 = 7,272 (F)
Rice + Sugar Beets	8,000[c] + 4,028 = 12,028 (D)	4,691[c] + 2,538 = 7,229 (D)
Cotton + S. Berseem	5,800 + 1,320 = 7,120 (D) 6,190 + 1,813 = 8,003 (F)	3,675 + 830 = 4,505 (D) 3,898 + 1,142 = 5,040 (F)
Cotton + Sugar Beets	5,800 + 4,028 = 9,828 (D)	3,675 + 2,538 = 6,213 (D)
Cotton + Broad bean	5,800 + 2,810 = 8,610 (D) 6,190 + 2,880 = 9,070 (F)	3,675 + 1,770 = 5,445 (D) 3,898 + 1,815 = 5,713 (F)
Maize + L. Berseem	4,226 + 2,940 = 7,166 (D) 4,643 + 3,511 = 8,154 (F)	2,662 + 1,850 = 4,512 (D) 2,925 + 2,212 = 5,137 (F)
Maize + Wheat	4,226 + 1,995 = 6,220 (D) 4,643 + 2,860 = 7,503 (F)	2,662 + 1,256 = 3,918 (D) 2,925 + 1,801 = 4,726 (F)

[a]Calculated from consumptive use requirements using a field efficiency of 70% and a conveyance efficiency of 90%

[b]Data taken from Mahdy, 1996; Hussain and Seckler, 1994

[c]Data for rice water requirements for the Delta are taken from Ministry of Irrigation, 1987. The data from Hussain and Seckler, 1994, for rice appear to be substantially different from data from other sources, although for the rest of the crops, these data appear consistent. Consumptive use and diversion requirements

for rice in Fayoum are adjusted for the difference in potential evaporation (Etp) as reported in Hussain, et al., 1994

While diversions and consumptive use amounts given in the tables represent seasonal requirements, since the rice growing season is shorter than cotton, diversions per unit time are much higher for rice than cotton, which contributes to the canal capacity problem. As rice cultivation increases, this capacity constraint becomes more pronounced, since the water demands are concentrated in a short period.

Table 4.2. Change in water consumption and profitability by crop rotation (Inter-cropping not included).

Rotation change	Change in field requirement (m^3/fed)		Change in consumptive use (m^3/fed)		Change in profit (LE per feddan - 1996)	Change in income (LE per m^3 saved)[b]
	Delta	*Fayoum	Delta	*Fayoum		
Rice/L. Berseem to Cotton/S. Berseem	-3,820	-4,168	-2,036	-2,629	- 331	-0.16(D) -0.13(F)
Rice/Wheat to Cotton/S. Berseem	-2,875	-3,519	-1,442	-2,218	+ 350	0.24(D) 0.16(F)

Rice/Broadbean to Cotton/Broadbean or Rice/Sugar Beets to Cotton/Sugar Beets[a]	-2,200	-2,472	-1,016	-1,559	+ 561	0.55(D) 0.36(F)
Rice/L. Berseem to Maize/L. Berseem or Rice/Wheat to Maize/Wheat[a]	-3,774	-4,018	-2,029	-2,532	- 683	-0.34(D) -0.27(F)

[a]Calculated from individual crop water requirements and profitability, so that the gains or reductions are measured only by the changes in water requirements and profitabilty across rice and cotton or rice and maize.
[b]Based on consumptive use changes. Note that for some rotations, income increases. However, for the most profitable rotations (rice/long berseem to cotton/short berseem) income declines.

Changing from rice rotation to maize rotations yields somewhat larger reductions in diversions and consumptive use, but the profitability of cotton rotations is generally above that of maize (Table 4.2), and thus losses in farm income would be greater.

Thus, depending on the rotation chosen, and assuming that the production in “illegal governorates” can be controlled by land limits, a range of from 0.024 to 0.04 bcm of consumptive use could be “saved” with a conversion to cotton rotations, with the most profitable rotation saving about 0.04 bcm. With a maize rotation, diversions requirements would be reduced from about 3,700 to 4,000 m^3/fed and consumptive use, by about 2,100 to 2,500 m^3/feddan, which gives a total saving in consumptive use of about 0.048 to 0.056cm.

4.1.1.1 Constraints and Limitations The enforcement of these reductions in the past has involved destruction of rice nurseries in the illegal areas. This approach appears to be the only practical physical means of controlling rice cultivation, since it involves limited areas and limited manpower on the part of the GOE. Destruction of fields of planted rice is not practical. However, nursery destruction can create significant political opposition among farmers, and probably has a limited potential in the long term. Moreover, the policy is in conflict with the policy of liberalization of farmer choice.

4.1.2 Unauthorized Rice Cultivation in "Legal" Governorates In addition to illegal lands, some farmers are growing rice in unauthorized areas of the "legal" governorates. In these rice growing areas, the Agricultural Extension and District Engineers (or their representatives) each year identify the specific land which can be cultivated in rice. Normally, about one-third to one-half of the area within a canal service area will be so identified, corresponding to 2- or 3-year rice rotations. In some areas, these proportions may be as low as 20 percent of the surface area. Rice grown outside of these designated areas is unauthorized, or "illegal" (Elwan and Tantawi, personal communications to the Rice Working Group, 1998).

problems arise. First, rice areas must be sufficiently separated from other crops so that water logging (subsurface water) does not cause damage to

Otherwise, adjoining farmers suffer losses from cropping anything but rice, and

cultivation has a tendency to cause even more unauthorized production. Secondly,

use for illegal rice normally is obtained by pumping either drain water or groundwater

provide from canals and mixing stations. Water control becomes problematic for

As in the case of "illegal lands," prevention of illegal cultivation

perspective. It is estimated that 434,600 feddan of unauthorized rice were planted in

Fayoum governorate (Table A.1). Changing rice rotations to cotton rotations on

lands would result in a diversion reduction of 1.0 to 1.75 bcm and consumptive

rotation change yielding a reduction of 1.75 bcm and 0.94 bcm, respectively.

rotations with similar winter crops.

The

about 0.9 million feddan in 1988 to about 1.1 million feddan in 1997 (Table A.1).

There appears to have been an upward trend in allowed area, but instances of authorizations in excess of 1.0 million feddan occurred prior to 1988. The MPWWR has suggested that the permissible rice area should be between 0.7 million and 0.9 million feddan for salinity control, which is 200,000 to 400,000 feddan less than currently allowed. Most of the increase in rice cultivation is in the Delta (the increase in allowed rice in Middle Egypt is very small). A reduction in rice area to 0.9 million feddan would add another 0.2 to 0.41 bcm of consumptive use savings for shifts to a cotton rotation (0.41 bcm for the most common rotation), or about a 0.4 bcm for a shift to a maize rotations with similar winter crops (Table 4.3b). Reducing rice cultivation to 0.7 million feddan would double these savings (Table 4.3a).

4.1.2.1 Constraints and Limitations While control of "illegal" rice in legal areas can be rationalized from a legal standpoint, physically enforcing the reduction of rice cultivation on these lands may be more difficult. First, nurseries are needed for both legal and illegal production, so their destruction may not be feasible. Secondly, maintenance of surveillance of both land and of pumping by irrigation and agricultural engineers would be very time consuming and costly.

There are also some general system constraints which apply to the reduction of rice cultivation. They are discussed below, but it should be recognized that these constraints apply to any and all rice reduction policies.

There is a clear constraint on the maximum rice reduction in Egypt based

the necessity to control salinity in the Northern Delta. The saline aquifer which

underlies

migration when the hydraulic pressure gradient permits. Periodic flushing with

fresh water is required to reduce this upward migration. As “dry footed”

crops

reducing hydraulic pressure against saline migration. Rice cultivation in a two-

rotation provides sufficient hydraulic pressure to reverse the upward

migration

Wailes, et al., 1995). If one examines the region underlain with aquifers

10,000 ppm of salt or more, and examines the extent of this land, the

annual

required for this salinity control (Zhu, personal communications to the Rice

Group, 1998). There is evidence that rice cultivation has actually

improved

This requirement may vary somewhat depending on the level of salinity in the

which one chooses to define as critical. Moreover, the demarcation of the

10,000

hydraulic factors change.

A

production. At present, per capita rice consumption is estimated at from 37 to 40 kilograms of white rice per person per year. With a population of 62 million, Egypt is estimated to consume about 2.3 to 2.5 million metric tons per year. Given an average conversion rate of 0.714 for paddy to white rice, this implies that about 3.5 million metric tons of paddy must be produced to assure self-sufficiency. At a production rate of 3.5 tons of paddy per feddan, it would require about 1 million feddans of rice for Egypt to be self-sustaining, and that requirement would increase as population grows. At least one researcher has suggested that 1 million feddan of rice be established as a "safe" level of production (Tantawi, personal communication to the Rice Working Group, 1998).

Finally, as is the case for "illegal" areas, unauthorized rice cultivation suggests that farmers do not have free choice of crops in those areas.

4.1.3 Variety Substitution Two rice varieties have been developed which purport to reduce water consumption: Giza 177 and Sakha 102. Both varieties reduce the time from planting to harvest by about 40 days (120 days compared to 160 days for current longer-season varieties such as Giza 171 and Giza 176). For highly saline soils, Giza 178 provides a somewhat reduced season of 140 days (Tantawi, personal communication to the Rice Working Group, 1998). In addition, these new varieties have been shown to have as high or higher yields than the longer season varieties, making them attractive to farmers. The savings in water

a 25% reduction), which would amount to from 2,000 (Delta) to 2,200 (Fayoum)

[3] per feddan. This diversion is consistent

about 1,260 to 1,400 m per feddan. The smaller of the two numbers seems more

likely,

requirements to less than cotton and most (if not all) rice area in the Delta..

total conversion of all rice cultivation in 1997 to the new varieties (1.566

million

3.13 bcm and a consumptive use saving of about 1.98 bcm. Assuming that illegal

cultivation is controlled so that only 700,000 feddan of rice are grown, varietal

substitutio

consumptive use of about 0.88 bcm. For 900,000 feddans, the savings are 1.8 bcm

1.13 bcm, respectively, and for 1 million feddans, 2.0 bcm and 1.26 bcm,

respectively.

______ Constraints and __________ The estimated water savings have

been

irrigation season. However, no "on-farm" data on water savings have been

collected.

test on the Sedi Gamea Canal in the Kafr El-Sheikh Governorate (Disuq

district)

obtained to more accurately project the effects of varietal substitution. It should be noted that an estimated 400,000 feddan are already planted in Giza 177 (Tantawi, personal communications to the Rice Working Group, 1998), but the mix of short and long season varieties limits water savings, since water is provided for the long season varieties in any given area (Elwan, personal communications to the Rice Working Group, 1998). However, given that there are some areas already in short season rice, the total substitution of new varieties would yield a correspondingly lower diversion and consumptive use reduction (2.3 and 1.4 bcm compared to the full conversion savings cited above).

Where rice cultivation is required for salinity control (in the Northern Delta region) the introduction of short season varieties may have an impact on salinity intrusion, since less water will be applied. However, estimates suggest that flooding for the short season varieties will be sufficient (Elwan, personal communications to the Rice Working Group, 1998). It is recommended that the salinity movement in the soil profile and in the aquifer in general be monitored as short season varieties are introduced.

Further, as indicated above, the capability of the system to deliver water over short periods of time, as might be required for the extensive use of short-season varieties, is limited by canal capacity. Currently, the Irrigation Sector of the MPWWR is finding it difficult to provide sufficient flows to satisfy the increased

developed at the “tail” of canals. Thus, there is a physical limit to the amount of

area, even with the introduction of short season varieties. The extent and level of the capacity limits should be quantified more precisely.

the shortening of the rice cultivation season from 160 to 120 days will allow increased inter-seasonal cropping, albeit at a reduced consumptive use

ement. For example, an extra 40 days of cultivation of maize for fodder cultivation ^{3} and consumptive use of

133 m^3

calculated value above. In addition, the short season varieties could allow for

cropping rice, although pest and disease problems, and perhaps soil fertility decreases,

communication to the Rice Working Group, 1998).

4.1.4 On-Farm _____ Efficiency

irrigation efficiency in rice growing does exist, although it is limited. It is

to reduce water application somewhat during tillering and maturation stages.

application savings of from 500 to 1,000 m per feddan might be obtained (Tantawi, personal communications in the Rice Working Group, 1998). However, 4.1.4.1 Constraints and Limitations These field application savings may not materialize in normal farming practice, even with new varieties. It is hoped that the rice policy test areas can be broadened to include these improved techniques in the future. Clearly, rice evapotranspiration (ET) requirements are higher than "dry-footed" crops. However, a significant portion (estimated at 57% according to Wailes, et al., 1995) of the water applied to rice reenters the water system in the form of groundwater or drain water augmentation. Where quality degradation is a factor in rice cultivation, controlling rice cultivation may increase the quality of available water elsewhere, but the net change in total (global) water availability in the system will not change a great deal except when those savings occur on the "last" reuse in the system (that is, reduce the outflows to the Mediterranean Sea and the Northern Lakes).

4.1.5 Water Reduction A final physical approach would be for the GOE (the MPWWR) to simply provide less water to existing irrigated acreage as it diverts water to "new" lands. Obviously, the cost of having unexpected water shortages at the farm level could be very substantial. Thus, any reduction in water availability would have to be accompanied by a substantial public information/public relations campaign, including potential alternatives which the farmers might consider as water reductions occur. There are historical periods of drought (the early 1980's, for example) when these reductions were contemplated and farmers informed.

___.5.1 _________ and Limitations Water releases from the HAD, in the Nile main stream, and flows in the main canals are managed volumetri

and maintaining water levels. Allocation of fresh water at these lower levels is not without measurement which implies improved control. The current lack of

MPWWR control of access to drainage waters and shallow groundwater is unlikely present without a significant increase in the technical capacity of the system and the

water scarcity. Thus, physical control of water availability to affect rice cultivation

A serious equity problem also emerges as a function of lack of control, since to water at the "tails" of both the branch canals and mesqas may be restricted as farmers at the "heads" of the branch

for rice use. Under reduced water availability at the main or secondary canal level,

4.1.6 _______ Farming Techniques Modern farming techniques such as rice on platforms for mechanical transplanting may result in an estimated personal communication, June 1998).

4.1.6.1 Constraints and Limitations. Nursery area is a small percentage of total rice area with just one month duration even under traditional practices. Furthermore, it is uncertain how many rice farmers would adopt mechanical transplanting techniques.

4.1.7 Summary of Water Savings Potentials Tables 4.3a, 4.3b, and 4.3c present a summary of the potential water savings from the various interventions described. These savings are based on potential changes of rice to other rotations, so that the discussion of physical/targeted economic and economic programs, if they produce similar shifts in cropping patterns, would result in similar savings. Note that the sum of all savings is only about 25 percent larger than the calculated saving in consumptive use obtained by converting all production to short season varieties. However, that magnitude of savings may not be forthcoming, as noted above.

4.2 Physical/Targeted Economic Programs

These alternatives would be combinations of physical and targeted economic (financial) disincentives and/or incentives. The objective of this kind of approach is to identify possible physical constraints and implement them through financial incentives or disincentives. This approach is currently practiced in the form of fines for rice cultivation in illegal areas. Two factors must be considered: first, the

economic/financial incentive/disincentive must be sufficient to induce the farmer

indication of rice fines

by

drastically above those of cotton (Table 2.2). It appears that a fine of from LE 300

LE 1,000 per feddan of rice would be sufficient to change the relative

prof

for rice of from 10 to 50 percent, the upper bound of which is consistent with

estimation using programming models of Egypt's agriculture (Lofgren,

1995).

consumption, may make the required fine larger than might otherwise be expected.

fines have been the main financial disincentive used in Egypt, other

nations

Program [CRP], in which farmers are "paid" to put some land into conservation

- that is, not to crop those areas. This program has been successful in

reducing

amount of wheat produced has not diminished proportionately as farmers have

the intensity of cultivation on the lands in production. The annual costs of such a program would be about the same order of magnitude as the differences in profitability (from LE 300 to LE 600 per feddan), or the order of LE 250 to 500 million annually, depending on the

Table 4.3a. Summary of water savings - conversion from rice to other rotations; maximum of 700,000 feddans of rice cultivation

Policy Action	Area (feddan in 1997)	Field requirement reduction (bcm)	Consumptive use reduction (bcm)	Est. farm income loss/yr (million LE)
Illegal land - Delta	23,000	0.05 - 0.09[a]	0.02 - 0.05[a]	7.6
Undesignated - Fayoum	21,800	0.05 - 0.09[a]	0.03 - 0.05[a]	7.2
Undesignated - Delta	434,600	0.96 - 1.66[a]	0.44 - 0.88[a]	143.8
With 700,000 fed maximum	386,500	0.85 - 1.48[a]	0.39 - 0.79[a]	127.9
Crop substitution	700,000	1.40	0.88	--[b]
Total (most probable)	1,565,900	4.72	2.65	286.5

[a]most probable savings from a switch from rice/long berseem to cotton/short berseem rotation.
[b]under investigation in Kafr El Sheikh policy test area.

Table 4.3b. Summary of water savings - conversion from rice to other rotations; maximum of 900,000 feddans of rice cultivation

Policy Action	Area (feddan in 1997)	Field requirement reduction (bcm)	Consumptive use reduction (bcm)	Est. farm income loss/yr (million LE)
Illegal land - Delta	23,000	0.05 - 0.09[a]	0.02 - 0.05[a]	7.6
Undesignated - Fayoum	21,800	0.05 - 0.09[a]	0.03 - 0.05[a]	7.2
Undesignated - Delta	434,600	0.96 - 1.66[a]	0.44 - 0.88[a]	143.8
With 900,000 fed maximum	186,500	0.41 - 0.71[a]	0.19 - 0.38[a]	61.7
Crop substitution	900,000	1.80	1.13	--[b]
Total (most probable)	1,565,900	4.35	2.49	220.3

[a]most probable savings from a switch from rice/long berseem to cotton/short berseem rotation.
[b]under investigation in Kafr El Sheikh policy test area.

Table 4.3c. Summary of water savings - conversion from rice to other rotations; maximum of 1,000,000 feddans of rice cultivation

Policy Action	Area (feddan in 1997)	Field requirement reduction (bcm)	Consumptive use reduction (bcm)	Est. farm income loss/yr (million LE)
Illegal land - Delta	23,000	0.05 - 0.09[a]	0.02 - 0.05[a]	7.6
Undesignated - Fayoum	21,800	0.05 - 0.09[a]	0.03 - 0.05[a]	7.2
Undesignated - Delta	434,600	0.96 - 1.66[a]	0.44 - 0.88[a]	143.8

With 1,000,000 fed maximum	86,500	0.19 - 0.33[a]	0.09 - 0.18[a]	28.6
Crop substitution	1,000,000	2.00	1.26	--[b]
Total (most probable)	1,565,900	4.17	2.42	187.2

[a]most probable savings from a switch from rice/long berseem to cotton/short berseem rotation.
[b]under investigation in Kafr El Sheikh policy test area.

reduction desired. It is doubtful that the GOE could afford such a program.

4.2.1 Constraints and Limitations While fines levied against rice cultivation should be effective in changing profitability, the efficacy of their use depends upon the associated expectations on the part of farmers. In the past, even though relatively large fines have been levied on rice producers, those fines have been frequently "forgiven" by the People's Assembly on appeal from farmers. Thus, farmers will implicitly discount the amount of the fine imposed by his subjective probability of having to pay it (including being "caught" at all). In order to be effective at limiting rice cultivation, the fine must discourage farmers from planting rice, rather than serve as a revenue generator after the fact. Thus, a strong commitment by the GOE to enforce fines is a necessity.

4.3 Economic Strategies and Measures

Economic strategies generally focus on changing the financial returns to crops, and in particular the returns to rice relative to other crops. These may include direct methods, such as price supports or price ceilings, or indirect methods, such as altering input costs, imposing land or crop taxes, providing subsidies and/or control of competition (particularly from international markets). It should be noted that economic strategies generally assume that profitability is the prime objective of farmers as they select crops to grow.

4.3.1 Direct Price Control The GOE has in the past controlled the farm-gate prices of commodities, primarily by controlling farmer access to markets and setting purchase prices for commodities. One of the primary reasons given for increasing rice cultivation was the relinquishing of governmental controls over the market. Clearly, reimposition of price controls could be an effective deterrent to rice cultivation.

4.3.1.1 Constraints and Limitations Price controls have proven both costly and institutionally difficult to Egypt and to other countries. Under the current system of farmer free choice, it is very unlikely that a return to price controls at below-market levels will be acceptable to the Ministries or to farmers. Further, past studies have suggested a relatively weak own-price response - a 10% decrease in the price of rice was estimated to bring about a 1.6 % decrease in rice cultivation (Hussain and El-Kady, 1995). This study used data which included a preponderance of observations from the period in which prices were controlled by the GOE, so that its results may reflect administrators' preferences rather than farmers'. Agricultural supply response is usually thought to be relative more elastic than the study indicated, particularly in the medium and long runs.

Price supports for alternative crops, such as cotton or maize, could have an impact on the amount of rice grown, as well. The Hussain and El-Kady study (1995) showed a relatively weak response from cross-price effects from cotton - a 10% increase in the price of cotton would bring about a 0.2 % decrease in rice cultivation). Maize showed a stronger cross-price effect - a 10% increase in the price of maize would bring about a 2% decrease in rice production. One expert (Rizk, personal communication, 1998) suggested that a minimum price of about LE 120 per ardab would probably be necessary to encourage a shift from rice to maize cultivation.

World price fluctuations may be relatively large, making price setting and import restrictions at a national level potentially costly in terms of hard currency exchange. In general, the experience internationally with price supports of any kind suggests that these programs are quite costly and difficult to administer, particularly in volatile markets.

4.3.2 Input Costs Crop profitability can also be changed by altering the markets and prices for necessary inputs. First among these possibilities, where water use is a critical factor, would be establishing a fee for water use after rehabilitation of the system physically and institutionally. 4.3.2.1 Water Fees. In most countries where water fees are used, the fees represent an attempt to recover costs of water delivery system development and operation and maintenance, rather than a full market price which would include the opportunity cost of water in alternative uses. Since rice is a large diverter of water relative to other summer crops, a water fee could have some differential impact.

4.3.2.1.1 Constraints and Limitations Water fees which are set to recover costs are seldom sufficient to change crop rotations significantly. Since measurement of water at the farm level is currently impossible and since the MPWWR has announced a policy opposing water pricing, the capacity to use fees is, at best, limited. Fees do not necessarily impact a specific target, like rice. The application of a fee must insure that the differential water diversion or consumption "costs" enough to change crop choices, and this kind of fee has to reflect opportunity costs of the water (that is, be a full price rather than a cost recovery fee). Thus, it is unlikely that water fees would be either feasible or effective.

4.3.2.2 Water Fines The GOE, through Law 12 of 1994, has made fines for excessive and irrational water use a feasible alternative to water fees. In fact, the Minister of MPWWR can, by decree, set the fines for excessive water use. Where areas within the "legal" governorates are designated as non-rice producing, use of water (in this case, difference in diversions between

cotton

rice. For example, fines of from 12 to 25 piasters per excess m would result in a

fine

should be noted that after fines of 7 piasters were paid by farmers in 1995, the

of land in rice cultivation fell from about 1,500,000 in 1995 feddan to

about

may have influenced farmers to grow less rice in 1996, including profitability of

crops, expected price changes in rice, etc. Therefore, to attribute the entire

change to the excess water fines is probably not accurate.

.2.1 and Limitations The assessment of the

act of water fines on farmer behavior suggest that only when the fines are

substantial

would cropping patterns change. Note that, because of the way in which the fines

levied (as calculated excess water diverted), these fines are more like fixed land

taxes on rice than true water fines. Moreover, as in the case of fines on rice

4.3.2.3 special input It should be recognized that the GOE

has

intervention in markets for inputs is opposed to that general concept. On the other hand, some specific inputs to rice production could possibly be targeted by taxes or other measures to change the relative profitability of rice. For example, increasing the price of rice seeds could change the profitability of rice for the farmers. Other variable inputs which are heavily used in rice production (specific fertilizers or herbicides) could also be taxed to reduce rice profitability. Where the GOE is directly responsible for inputs (seeds, for example), prices might be directly established.

4.3.2.3.1 Constraints and Limitations Once again, to affect cropping choices, the impacts on profitability of rice must be such that other crops become more profitable than rice. Further, implementing fees on some inputs as opposed to others may result in input substitutions and changes in yields, but no changes in cropping patterns. For example, taxes on rice seeds would simply cause a shift to home-grown seeds. Currently about 62% of rice seeds are retained from the previous season. Of the remaining seeds, 78% are provided by the GOE and 22 % by private producers.

Input substitution is a reasonably complex issue, and there appear to be little data on which to base the selections of any input taxes or price changes. Imposition of taxes on inputs may have unexpected impacts on the agricultural sector and should be undertaken only with a substantial understanding of the market conditions and with the greatest of care.

Finally,

of agriculture and agricultural-related markets, and a movement back to the

4.3.2.4 Land or Taxes

be levied against land on which rice is grown. Of course, such taxes must be

on rice crops specifically. A lump-sum general tax will not affect the

choice

way as the water fines or rice cultivation fines. Such taxes must be sufficiently

high

crops.

4.3.2.4.1 Constraints Limitations

effect as the excess water tax, and the same constraints and limitations.

4.3.2.5 Elimination Rice Import The GOE implemented, and

has [2] and

rice from international sources. The result has been that farm gate prices for

rice

analysts suggest that as farmers' access to markets has been opened, rice prices

risen above the world market price at the farm gate due to internal

speculation.

2

profitable, and the current farm gate price for rice in Egypt appears to be higher than the world price would suggest (Ariza-Nino, personal communications to the Rice Working Group, 1998). Should the import tariff be reduced or eliminated, the farm gate price of rice would be expected to fall, which would reduce the desirability of rice as a crop.

4.3.2.5.1 Constraints ___ Limitations

little hard empirical evidence relative to the effect of import duty elimination on farm-gate price of rice, and therefore, on the production of rice. Some have suggested that much of the increase in land in rice cultivation from 1988 can attributed to the price differentials in the world markets for white and baladi rice personal communications to the Rice Working Group, 1998). This would

above, this responsiveness is questionable and the limited data available on farmer nse since the market was de-controlled does not permit a quantified estimation.

summer crops. World prices in cotton have fallen significantly during the past decade,

pattern as both a profit augmenting and risk reducing crop.

4.4 Long Term Vision After Irrigation Improvement

The GOE has committed itself to the development of free choice of cropping patterns by farmers. A long term strategy for water resources should consist of steps which will assure farmer incentives for physically and economically efficient use of water. Such a strategy would consist of:

(1) The identification of relatively independent regional agencies, public or private, for whom water is allocated **with certainty subject to climatic variations** and to whom is given the responsibility and authority for both distribution and the operation and maintenance of the system. Fixed water allotments by themselves will provide incentive for the agencies and the farmers to conserve water. It should be noted that without control of water, such allocations are not possible. Thus, the completion of IIP programs, or similar improvements at canal levels higher than the mesqa level, will be mandatory.

A decree permitting these agencies to charge water users for O&M costs is necessary. Democratic processes for the determination of the leadership of such agencies would be recommended. The GOE would be responsible only for the initial allocations of water, and for the calculation of main-system O&M charges to be made to the regional agencies.

(2) The option to trade water both among users within a given agency's purview and between agencies should be permitted, so long as the GOE has the responsibility for assuring the elimination of third party effects.

(3) The charges levied by these agencies should be subject to GOE oversight

to prevent monopoly pricing (public utility regulation).

these changes, it will be unnecessary to "force" the choices of farmers,

and

trades.

Finally,

main system and of new sources of water as follows:

(4)

capacity should be undertaken, particularly should short season rice varieties prove

(5) A physical and economic analysis of improving water management and

control

be created. Water can only be allotted when it can be measured and controlled.

(6)

development of new sources of water should be undertaken.

5. POLICY IMPLICATIONS AND RECOMMENDATIONS

The data and analyses presented above suggest that rice is a preferred crop for farmers, as a result of both profitability (at least with respect to the most prevalent crop rotations), risk reduction, and home consumption. Increasing rice cultivation has already put strain on the Egypt water supply and reduced water availability to "new" lands at the ends of canals, as peak delivery capacities have been reached in some canals. The issue is clear: without additional water in the system or reducing outflows, the only way in which the GOE can expand irrigation into "new" lands is to reallocated water from existing irrigation to those new lands. The main problem that the GOE faces in this reallocation is maintaining the welfare of those who are dependent on the "old" lands. The GOE must develop short- and long-term policies which provide for the reallocation of water and a reasonable maintenance of the welfare of its citizens.

5.1 Recommended Policy Options

There are five recommended policy options. The following are brief descriptions of each policy option. Each is targeted at decreasing water demand by reducing either consumptive use by or area in rice cultivation.

Policy Option 1: Land Limitation on Illegal Rice Production. In 1997, about 23,000 feddan of rice were grown outside of the official permitted rice growing areas. If this illegal cultivation could be prevented, expected water savings could be as much as 0.047 bcm of consumptive use, or 0.09 bcm in diversions. Both the MPWWR and the MALR should apply appropriate policy measures including destruction of nurseries and/or permanent fields.

Policy Option 2: Prevent Illegal Cultivation in Official Rice Growing Areas. In 1997, about 434,600 feddan in the Delta and 21,800 feddan in Fayoum were illegally planted to rice in the official (permitted) rice growing areas. If this illegal cultivation could be prevented, expected water savings could be as much as 0.88 bcm of consumptive use, or 1.66 bcm in diversions, in the Delta; and 0.057 bcm of consumptive use, or 0.09 bcm in diversions in Fayoum. Policy measures for controlling this illegal cultivation include effective water fines and additional land and/or crop taxes.

Policy Option 3:Introduce Short-Duration Varieties and Modern Farming Techniques. Substitution of short duration varieties (~120 days) for longer season varieties (~160 days) could reduce water diversions by 25%. The expected water savings on 1 million feddans could be as much as about 1.26 bcm of consumptive use or 2.0 bcm in diversions. Policy measures needed for this option include a ministerial decree and a national extension campaign to provide education and information to rice growers concerning the short duration varieties.

The total expected water savings from the first three policy options could amount to about 2.42 bcm of consumptive use or about 4.17 bcm in diversions (on

1 million feddans) as illustrated in Table 4.3c.

Policy Option 4: Better Water Control in Permitted Rice Growing Areas. Better water management and control of water in permitted rice growing areas can be accomplished through 1) establishment of Water User Associations, 2) introduction of modified drainage systems, and 3) removal of physical bottlenecks in the irrigation delivery system, where required, to improve water distribution.

Policy Option 5:Elimination of the Rice Import Duty. The intended impact of the removal of the rice import duty is to decrease the rice farm-gate price, and hence the desirability of rice as crop choice. There is little hard empirical evidence relative to the effect.

5.2 Recommendations

1. Conduct a national campaign to introduce short duration rice varieties throughout all official rice growing areas.
2. Implement a program to eliminate the import tariff on white and baladi rice and conduct a comprehensive study on the effect of eliminating the rice import tariff on rice area and production.
3. Conduct a public awareness campaign on water scarcity targeted to farmers in official rice growing areas.

Reconsider how much rice should be legally grown in Egypt taking into consideration future needs and constraints.

Plan and implement effective programs for effective control of illegal rice production.

The physical and economic impacts of introducing short duration varieties in a

should be evaluated and monitored as part of Tranche III.

Rice Working Group Communications, Deliberations and Presentations, March

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APPENDIX - FEDDANS IN IRRIGATED RICE, 1986-1997